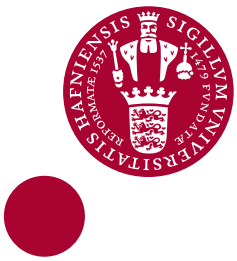

The crystal chemical role of Fe-Mn substitution in the epidote family

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New occurrences of red coloured minerals from the epidote family A1A2M1M2M3[O/OH/SiO2/Si2O7] have been found in Greenland and their structures have been solved. They are all monoclinic members of the ternary Al-Fe-Mn solid solution series with end members clinozoisite-piemontite-epidote [1]. Although they do not incorporate enough amount of Mn^{3+} to be classified as piemontite, their colour varies from pink to intense red. We encounter both Mn3+-enriched clinozoisite and Mn^{3+}-enriched epidote. As expected, Fe^{3+} and Mn^{3+} are substituting Al^{3+} exclusively in the M3 octahedra.

The distortion of the M3 polyhedron increases with increasing content of Mn, an effect that can be attributed to the Jahn-Teller effect of the $3d^4$ electron configuration of Mn^{3+} [2]. The Fe/Al and Mn/Al substitutions influence the distortions of other coordination polyhedra as well. The monoclinic structures can incorporate more Fe and/or Mn than the orthorhombic structure of zoisite. The distortions of atomic coordinations connected to atomic substitutions are reviewed to explain this difference. We also apply them for the quantification of the relative content of Mn and Fe in the structures of minerals from the epidote family.

[1] Liebscher, A.; Franz, G. (ed), *Epidotes, Reviews in Min and Geoch.* 2004, 56. [2] Langer, K.;, Tillmanns, E.; Kersten, M.; Almen, H.; Arni, R.K. *Z.Kristallogr*. 2002, 217.

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